

## VULNERABILITY ASSESSMENT SUMMARY

# Community Services and Assets in Peel Region: Port Credit Case Study



Prepared for:



Prepared by:



### Action on Climate Change in Peel Region

Addressing climate change is nothing new for the Region of Peel. The two regional Conservation Authorities, Toronto and Region Conservation Authority (TRCA) and Credit Valley Conservation (CVC), have been actively involved in climate change adaptation and mitigation initiatives for the past decade. The Region recognizes the importance of working together to build resilience and adaptive capacity to climate change at a local scale. In 2011, it partnered with the TRCA and CVC, as well as lower tier municipalities (Brampton, Mississauga and Caledon), to develop the Peel Climate Change Strategy.

The Strategy serves as a roadmap for addressing climate change impacts in Peel Region through the following:

- proactive and responsive planning and leadership
- actions to reduce greenhouse gas emissions
- targeted and proactive adaptation actions
- shifting to a green economy
- increasing awareness of, and engagement in, climate issues in Peel
- ongoing research and adaptive risk management

Peel commissioned the development of the vulnerability assessments to investigate the impacts of climate change on a variety of systems. The information gained in these assessments will help identify opportunities for adaptation to climate change and reduction of its negative effects.

This vulnerability assessment was completed in 2016 to assess the impacts of climate change on critical services and assets that support community well-being in Port Credit, as a case study which can be extended to other communities in the Region. The following summary of that assessment was prepared by Hutchinson Environmental Sciences Ltd. and Shared Value Solutions Ltd., in collaboration with the Toronto and Region Conservation Authority, Ontario Climate Consortium and the Region of Peel.

The full technical report for this and other assessments is available at [climateconnections.ca](https://climateconnections.ca).

Note: Please refer to the full technical report for all source material used in the assessment and this summary.

Suggested citation for the full technical report:

Harris, S., Hazen, S., Fausto, E., Zhang, J., Kundurpi, A., Saunders-Hastings, P. 2016. **Climate Change Vulnerabilities of Community Services and Assets in the Region of Peel. A Case Study in Port Credit.** Toronto, Ontario: Toronto and Region Conservation Authority and Ontario Climate Consortium Secretariat.



## Preparing for the Future

Climate change is one of the greatest challenges humans face in the 21<sup>st</sup> century. As the planet warms, we are witnessing more extreme and variable climate patterns, which are leading to unprecedented impacts for society and natural environments worldwide. The warming trend is no longer reversible, which means that even if we drastically curb greenhouse gas emissions today, we will still continue to experience devastating climate change effects for decades to come. Adaptation is needed at all levels, from local to global, to adjust to the new reality under our changing climate.

### Calls to Action

The results of this vulnerability assessment, summarized over the following pages, make it clear that we must act now:

- ✓ Start or continue adaptation planning, leveraging this and other existing community assessments, to incorporate system thinking and enable evaluation of impacts at the property level.
- ✓ Protect and restore natural areas to strengthen flood resiliency and heat resiliency, including reducing the heat island effect.
- ✓ Evaluate impacts to infrastructure at a system and property level, ensuring more variable and unpredictable water levels are reflected in plans and design.
- ✓ Promote collaboration and support the implementation and communication of emergency preparedness and response initiatives, which involve health care workers, emergency responders, police and public health agencies.
- ✓ Promote collaboration and knowledge transfer with utilities and the public to better understand interdependencies, how climate change may affect them and what solutions may be supported (such as backup power and alternative power sources).
- ✓ Build public awareness of the hazards and impacts of climate change (such as heat waves, flooding).

The purpose of this assessment is to understand climate change impacts on critical services and assets that support community wellbeing in Port Credit, as a case study that can be extended to other communities in the Region.

### STAKEHOLDER ENGAGEMENT

A wide range of public and private sector organizations work together to plan for, design, and operate services and assets that support the well-being of citizens in Port Credit and other communities in Peel. As a result, it was important to gain input from a cross-section of these stakeholders for the assessment process. Participants included representatives from Environment and Climate Change Canada, the Ontario Climate Consortium, Peel Region, the City of Mississauga, Toronto and Region Conservation and Credit Valley Conservation.

## DEFINING VULNERABILITY TO CLIMATE CHANGE

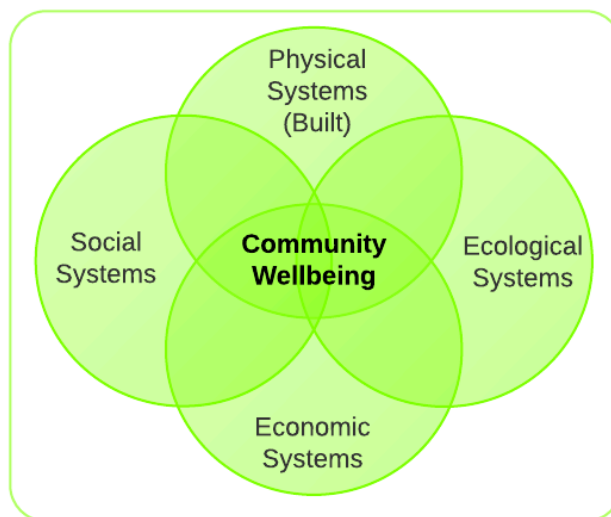
Many definitions of vulnerability to climate change exist. For the purposes of this assessment the definition from the Intergovernmental Panel on Climate Change was used:

**“Vulnerability encompasses... sensitivity or susceptibility to harm and lack of capacity to cope and adapt.”**

## How Does Climate Change Affect Community Services and Assets?

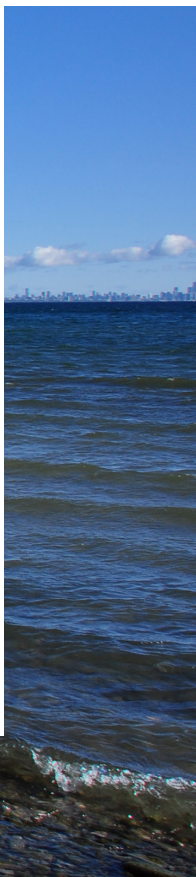
Climate and weather affect the large number of services and assets that combined provide the broader social, physical, ecological and economic systems that support community wellbeing. The planning, design and operation of services and assets consider climate and weather in many ways. For example, the timing and budgeting for snow removal, outdoor recreation, public health campaigns (flu season, for example), and tree plantings are all dependent on expected climate and weather. Infrastructure and building designs meet codes and standards to withstand likely temperature, wind, precipitation, humidity and other climate conditions. As the climate changes, so will the effectiveness of past assumptions about weather and climate that have driven the planning, design and operation of community services and assets.

### SYSTEMS SUPPORTING WELLBEING



### Community Services and Assets Affected by Climate and Weather

- Housing and Built Forms
- EMS and Fire Services
- Police
- Emergency Planning and Management
- Public Health
- Culture and Tourism
- Finance, Legal and Administration
- Economic Development
- Planning and Zoning
- Port and Coastal Management
- Parks, Recreation and Education
- Waste Collection
- Agriculture and Food Security
- Environmental and Ecosystem Management
- Water and Wastewater
- Energy
- Transportation
- Telecommunications





## Port Credit

The Port Credit planning area of the City of Mississauga is located on the shore of Lake Ontario surrounding the mouth of the Credit River. It spans an area of 227 hectares with a population of approximately 12,500 people.

Land use in Port Credit is predominantly residential, but includes important lake-based commercial and recreational areas, and an abundance of green space for recreation and wildlife habitat. There are several critical pieces of infrastructure in Port Credit, including the Lorne Park Water Treatment Facility, the GO Transit station and Canadian National Railway line, several large community recreation facilities and three large marinas.

Port Credit has undergone a long-term visioning and revitalization process as part of the City of Mississauga's Official Plan Review. This process has resulted in several planning and land re-development projects that present opportunities to address climate change adaptation, such as the Port Credit Local Area Plan Review, Inspiration Port Credit and the Lake Ontario Integrated Shoreline Strategy.

Port Credit was selected as the focus for the vulnerability assessment because it satisfied criteria set by the stakeholders. Specifically, Port Credit is a shoreline community that supports a diversity of community services and assets. It has ongoing policy and decision-making processes that could benefit from climate change analysis and an active community to participate in stakeholder engagement.

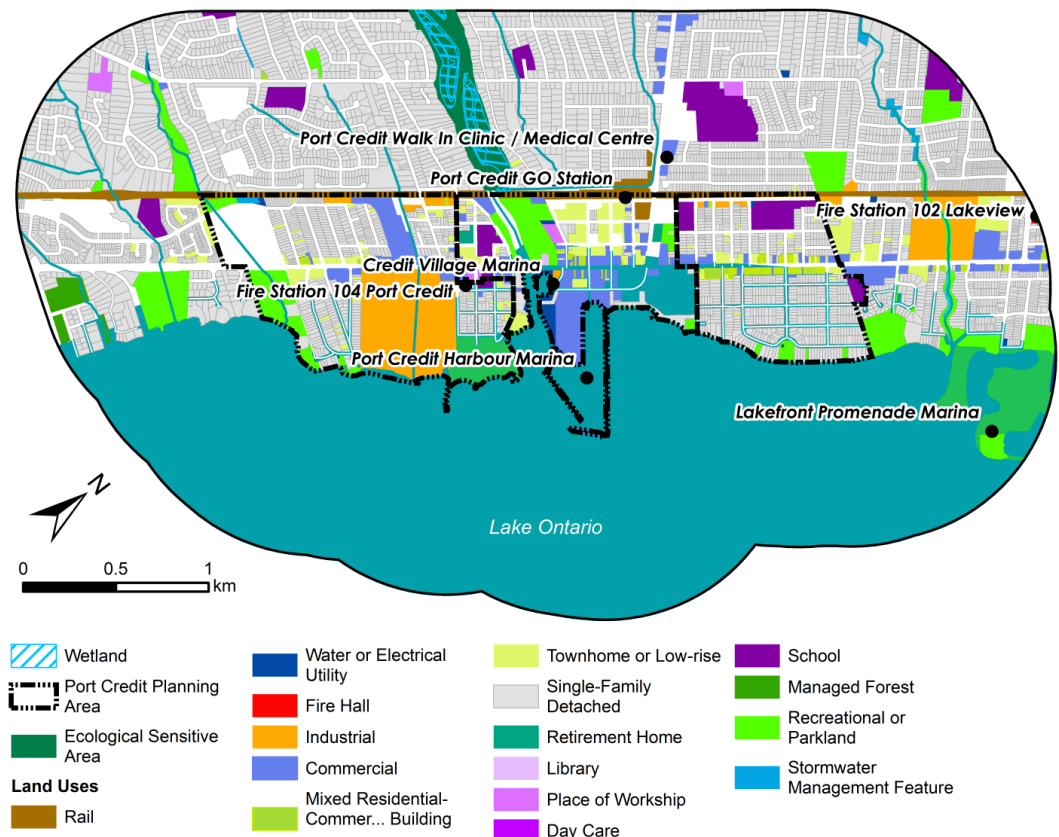
### DEFINING RESILIENCE AND ADAPTIVE CAPACITY TO CLIMATE CHANGE

The vulnerability of community services and assets to climate change will depend in large part on their resilience and adaptive capacity.

**Resilience** refers to a system's ability to cope with and recover from disturbance.

Resilience is closely tied with the concept of **adaptive capacity**, which is the ability to adjust and respond to changes.

### Land use and major community assets in Port Credit



## Past Climate and Weather Impacts in Port Credit

Historically, most climate impacts to Peel community services and assets have been caused by extreme weather events (such as drought, extreme heat and extreme rainfall), rather than by seasonal climate conditions (such as shifts in temperature and precipitation, freeze-thaw patterns, and changes in snow cover). Extreme precipitation and large storms have been the primary drivers of these impacts.

Climate causes a wide diversity of impacts to community services and assets. Many impacts are caused by multiple climate conditions, and affect many or all services and assets (such as damage to infrastructure, damage to urban tree canopy, loss of service capacity). Overall, 189 different types of climate impacts that affect Peel services and assets were identified by stakeholders. Impacts of particular importance to Port Credit include the following:

### Electricity

Electrical outages have widespread impacts on almost every service area.

### Public Health

A healthy population is key to community well-being. Climate affects people’s health directly, as well as indirectly through disruption to public health and emergency response services.

### Port and Coastal Management

The Lake Ontario shoreline is a critical cultural, recreational and economic asset for Port Credit. Variability and extremes in lake levels due to climate can cause impacts to shoreline properties, municipal infrastructure, ecosystems and recreational uses.

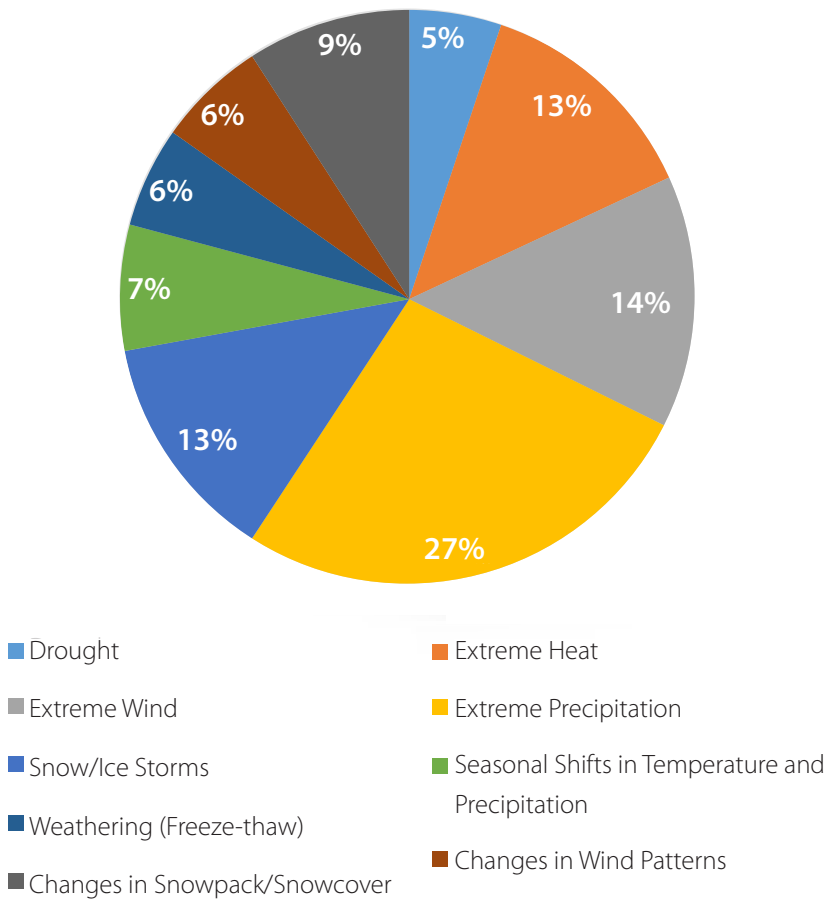
### Transportation

Transportation infrastructure (such as roadways and the GO Transit rail line) are critical to day-to-day life in Port Credit. Damage to these systems can result in significant disruptions to a range of other services, and can be especially problematic during emergency situations.

### Environmental and Ecosystem Management

Natural systems support many critical functions in urban environments. Compromised ecosystem health can affect everything from water supply, to provisioning of shade, to recreational opportunities and air quality regulation.

Breakdown of Impacts Associated with Different Extreme Climate Events and Seasonal Weather Conditions



# Possible Futures Under Climate Change

## Climate Trends in Peel Region

Predicting future climate is not an exact science, but trends can be forecasted based on a range of future greenhouse gas emission scenarios. Under business as usual, Peel Region is expected to be hotter at all times of year, with changes to seasonal precipitation patterns, more rainstorms and more heat waves. Winter, spring and fall will likely be wetter, while summer will be drier on average, but punctuated by heavy storms.

## What the Storylines Tell Us

A series of four storylines present the major climate vulnerabilities to services and assets in Port Credit. The storylines link research on critical climate change impacts with current conditions to identify vulnerabilities at the community scale.

**Storyline 1: Multiple Causes of Flooding in Port Credit**

**Storyline 2: A More Variable Lake Ontario Shoreline**

**Storyline 3: The Future of Power Outages in Port Credit**

**Storyline 4: Preparing Populations for Extreme Heat**

## FUTURE CLIMATE TRENDS IN PEEL REGION

A study of predicted climate trends for Peel Region found that

### By 2050



- Annual mean temperature will rise by 2°C



- The number of extreme heat days (over 30°C) will more than double



- The intensity of extreme storms will increase by 28-51%



- The growing season will be 20% longer than today

### By 2080



- Annual mean temperature will rise as much as 5°C from current levels



- There will be up to five times more extreme heat days



- The intensity of extreme storms will increase by 46-90%



- The growing season will be 30% longer than today







## Storyline 1: Multiple Causes of Flooding in Port Credit

Port Credit is exposed to different types of floods, including flash floods, gradual riverine floods, lake-based coastal floods, and urban drainage system floods. Climate change may increase the likelihood of floods, with different areas of Port Credit being at higher risk. The vulnerability of services and assets to flooding depends in large part on where they are located within the community. Specific characteristics of assets also determine their vulnerability to damage during flood events.

### What areas are most at risk?

Floodplains and areas along the Lake Ontario shoreline are at greatest risk of flooding in Port Credit because of their low elevation and proximity to water. There are many important community assets in these areas including schools, fire and police stations, health care and retirement facilities, recreational facilities, parks, and transportation, water and electrical infrastructure.

Urban flooding can also occur if storms exceed the design capacity of the drainage system (storm sewers, catch basins, ditches and culverts). Many areas of Port Credit were built prior to 1970, and their drainage systems may not be performing well because of age, leakages and poorly graded properties. In addition, much of the community is paved and built up, which prevents water from soaking into soils. As a result, there is more overland flow of water in these areas, making urban drainage systems more vulnerable.

### What assets are vulnerable to damage during floods?

Physical damage to assets and property by flooding is the major cause of disruptions to community services. When a flood occurs, some assets are more vulnerable to damage than others. The extent of damage depends on a host of physical processes — pressure and wearing action of water, impacts from debris, and the growth of mold and bacteria, for example — and how long they are experienced.

In Port Credit, characteristics of many homes make them more vulnerable to impacts during floods:

- 80% of properties are single-family homes, which are more vulnerable than multi-unit buildings
- 60% of homes are more than 45 years old and may have lost structural integrity over time, although home improvements may lessen this vulnerability
- 1/3 of households are rented properties, which may not be maintained as regularly as owned properties

Building heights, construction materials and foundation types also contribute to the vulnerability of buildings to floods. Property-scale studies are needed to better evaluate homes in Port Credit to determine their resilience to flooding.







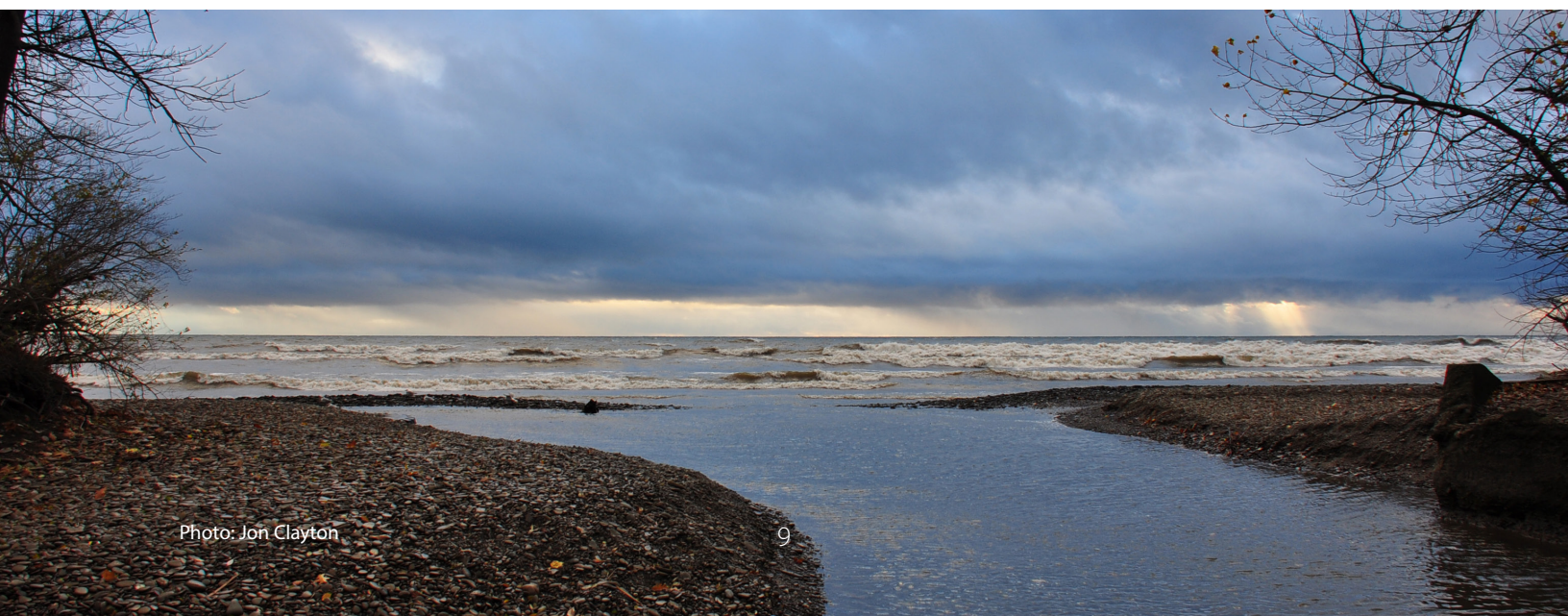
## Storyline 2: A More Variable Lake Ontario Shoreline

### Significance of Port Credit's Shoreline and Coastal Management

The Port Credit shoreline is a valued cultural, recreational, economic and ecological asset to the community and to Peel Region as a whole. As such, there are many planning efforts underway to ensure the long-term sustainability of the Port Credit shoreline, and implications of climate change is a key consideration. This storyline identifies coastal processes that are sensitive to climate conditions, and thus likely to change in the future, presenting vulnerabilities for coastal management.

Several coastal processes and characteristics of the shoreline area in Port Credit are sensitive to climate conditions. Extreme winds drive flooding, erosion and movement of sediments and debris along the shoreline. Mild winters reduce lake ice cover that protects the shoreline from erosion, while cold winters can cause ice to build up along the shoreline leading to ice jams in the Credit River and subsequent floods and erosion. Changes in regional precipitation and heat patterns lead to extreme high and low water levels in Lake Ontario. These climate impacts can result in a wide range of damage to assets and disruption of services on private properties, marinas, piers, beaches and natural shoreline areas.

Water levels in Lake Ontario have been regulated since the 1950s and have varied by up to two metres over this period. This variation has declined to less than a metre and a half in recent years. A new regulation plan by the International Joint Commission (which works to protect the Great Lakes) aims for a more natural management approach, and greater variability in water levels. Under the new plan, lake levels are expected to rise and fall beyond targeted levels under very wet or very dry conditions. Several projections suggest that levels will decline overall, but there is less confidence in these predictions as new studies emerge, and it remains unclear how water levels might vary from year to year. Uncertainty in climate change predictions has implications for coastal management of Lake Ontario water levels. Strategies will need to consider many possible lake level scenarios, and adaptive strategies will need to be able to respond to higher and lower lake levels than were seen in the past.





## Storyline 3:

# The Future of Power Outages in Port Credit

## Port Credit's Electrical Grid and Outages

The electrical grid is a critical asset in Port Credit. It distributes power throughout the community by a network of aboveground power lines, switches and transformers. The consequences of power outages can be serious, including high costs of repairing equipment, electrical safety hazards, loss of business, loss of power to households and issues for the management of many critical services and assets.

Extreme wind and buildup of snow and ice cause most damage to the Port Credit grid, or cause trees to damage it. Outages also occur because of deterioration of grid structures from weathering. Climate change is anticipated to produce more frequent storms and extreme weather that cause these types of outages.

## What Makes the Grid Vulnerable?

Physical and management characteristics affect the capacity of Port Credit's electrical grid to withstand storms and extreme weather conditions that can cause power outages and damage the grid. Critical factors that make the grid more or less vulnerable include design, age and construction materials of the grid, and exposure to trees.

### CAUSES OF POWER OUTAGES, JULY 2009 TO JANUARY 2014

- Weather events caused 54% of power outages.
- Trees caused 29% of power outages, often because of weather events.
- Most outages caused by weather and trees occurred in the summer.
- The extent of outages (number of transformers affected) was greatest due to weather events.
- Tree damage caused the greatest number of days with outages.
- An average of five outages occurred per transformer, but more occurred in eastern areas of Port Credit and in areas to the southwest within the buffer zone (Clarkson area).

Components of the grid are designed, in part, to bear the stress of climate conditions. For example, the Canadian Standards Association Overhead System standards require that structures are able to withstand wind gusts of 94 km/hr at air temperatures greater than 25°C in dry conditions. Weather events that are outside of the design range can cause damage to components of the grid. Damage can also occur because of material imperfections, design flaws, improper maintenance, or other hazards.

Age increases the vulnerability of the electrical grid to climate events. Over time, weathering and normal break down of materials can degrade or damage systems. While electrical grids are designed to last between 35 and 65 years, design standards change over this period. Older systems may not be designed to the same standards as newer systems making them more vulnerable to climate events. The average age of the Port Credit grid components is 25 years, but some components were installed or upgraded in the 1950s.

Construction materials influence vulnerability of the electrical grid to climate in different ways. For example, wood utility poles are more vulnerable if they are tall and old, or located in wet areas where they are prone to rotting. In Port Credit, 6% of wood utility poles are considered more vulnerable, because they are more than 35 feet tall and more than 45 years old (3%), or they are in flood hazard zones (3%).



Electrical grids are exposed to damage from trees (tree limbs hitting conductors, for example), especially if the trees are deciduous or old, and if the canopy is dense. Most trees in Port Credit are likely deciduous (as in Mississauga in general) and relatively old (over 60% of the properties are more than 55 years old and many trees are likely to be the same age), making older areas in the community likely to be more vulnerable.



## Storyline 4: Preparing Populations for Extreme Heat

Heat waves are long periods of extreme heat, which can cause serious and widespread human health problems. There are many heat-related illnesses, including heat cramps, fainting, heat exhaustion, and heat stroke. In some cases, exposure to heat waves can lead to death. Climate change is anticipated to produce stronger heat waves that occur more often, increasing the risk of heat-related health hazards.

Some people in Port Credit are more vulnerable to heat waves because of health, age and social factors that make them more likely to become ill or prevent them from knowing about heat warnings and acting on them to reduce the risk. Key factors include the following:

- Pre-existing health conditions (heart disease, mental illness, diabetes, obesity, respiratory illness, for example)
- Use of certain medications and drug or alcohol abuse
- Age (infants, children less than four years old and adults over 65 years old are more vulnerable)
- Lifestyles (working outdoors, playing sports or running outside, for example)
- Communication barriers (language barriers, for example)
- Social isolation (for example, no internet or cell phones; living alone)

The built environment can influence a person's vulnerability to impacts of heat waves. For example, the top floor of an apartment building without air conditioning can be much hotter than the ground level.

Built environments can also exacerbate the impacts of heat waves. Areas heavily covered by pavement and buildings retain more heat than natural areas such as forests and greenspace, and cause the Urban Heat Island (UHI) effect. UHIs can be up to five degrees warmer than surrounding areas, but areas with good tree canopy cover and the cooling effect of Lake Ontario help to lessen the effect of UHI in Port Credit.

Heat waves also worsen air quality (smog) as heat contributes to development of ground level ozone, greater pollen production and the spread of particulate matter (dust), which can cause respiratory illness, lower cardiovascular function and make pre-existing health conditions worse, especially breathing conditions such as asthma. Between 2003 and 2013, there were 58 smog advisories issued by the Ministry of the Environment and Climate Change for Peel Region.

Ongoing climate monitoring and evaluation of measures to reduce vulnerability will be key to a successful adaptive management approach.

## Where Do We Go From Here?

Information is key to effective adaptive management. Regular data collection will help improve our understanding of climate change and its effects on community services and assets, and this increased knowledge can then inform wise decision making. In particular, ongoing climate monitoring and evaluation of measures to reduce vulnerability will be key to a successful adaptive management approach.

This vulnerability assessment describes key critical impacts of climate change (floods, variable Lake Ontario water levels, electrical power outages and heat waves) on many community services and assets. Decision makers will need more information on other supporting systems, trade-offs among impacts and the effect of cumulative impacts (the combination of past, present and future impacts) to rank the importance of different impacts and prioritize management strategies.

Results of the vulnerability assessment highlight opportunities for adaptive management of climate change impacts on community services and assets in Port Credit.

### Opportunities to address vulnerability to floods:

- Encourage municipalities, businesses and residents to assess and mitigate lot-level flood vulnerabilities
- Maintain and clear debris from drainage systems
- Address threats to transportation networks (Go Transit station and main highways), water and wastewater utilities (pumping stations and the water supply network) and critical community and emergency services (health care clinics, food supply, financial services) in more detail
- Protect and restore natural areas to strengthen flood regulation

### Opportunities to address vulnerability to variable Lake Ontario water levels:

- Evaluate plans and designs to ensure they reflect more variable and unpredictable water levels, particularly for Inspiration Port Credit, the Waterfront Parks Strategy and the Lake Ontario Integrated Shoreline Strategy
- Evaluate impacts at an infrastructure and property level

### Opportunities to address vulnerability to electrical power outages:

- Study design and maintenance of the electrical grid components to determine how lifespans of equipment may change
- Consider use of other power sources (solar, wind and other renewable, low-carbon energy sources)

### Opportunities to address vulnerability to heat waves:

- Build public awareness of the health hazards of heat waves and how to prevent them
- Tailor messages to a diverse audience
- Provide and assess the use of public cooling stations
- Prepare emergency response plans that coordinate activities of health care workers, emergency responders, police and public health agencies
- Protect and restore natural areas to combat urban heat island effect





